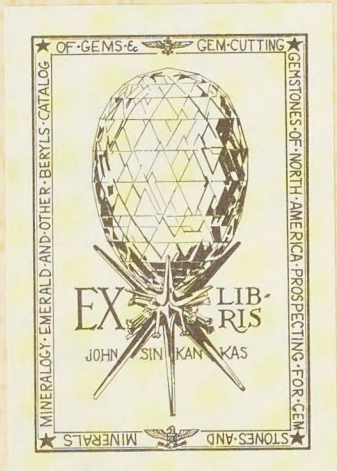
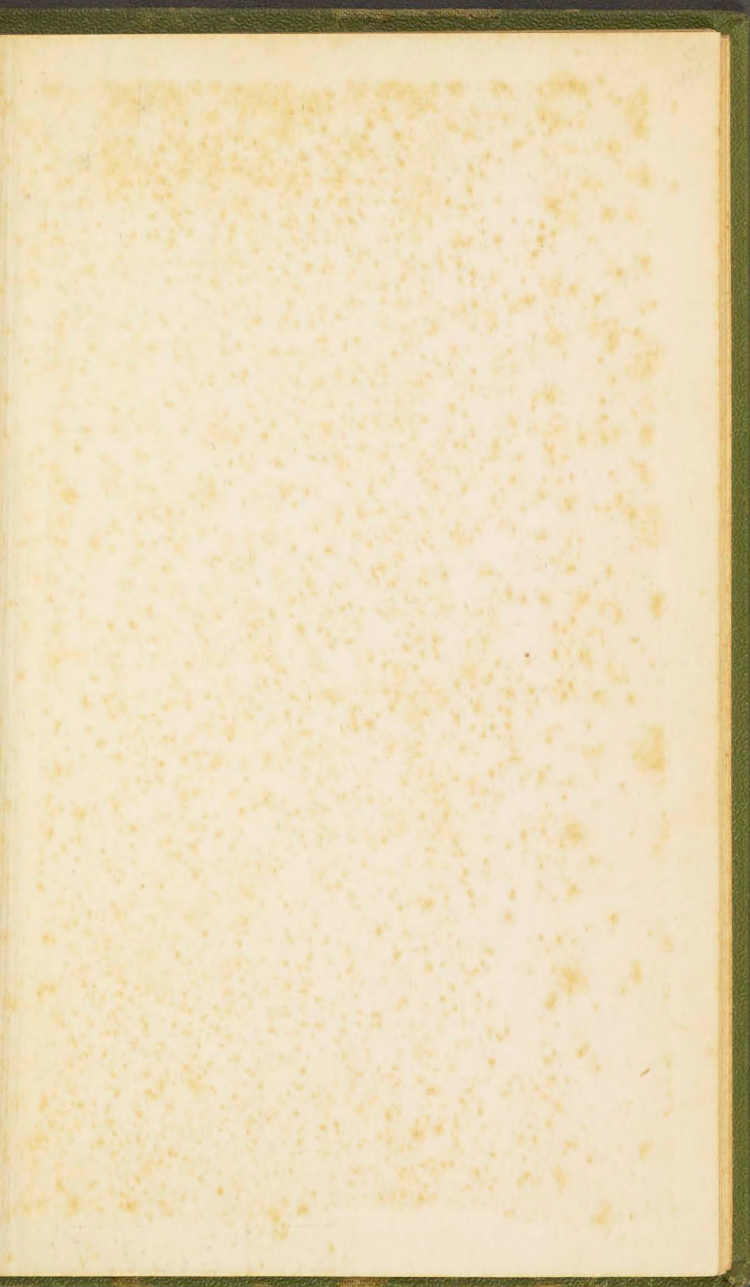


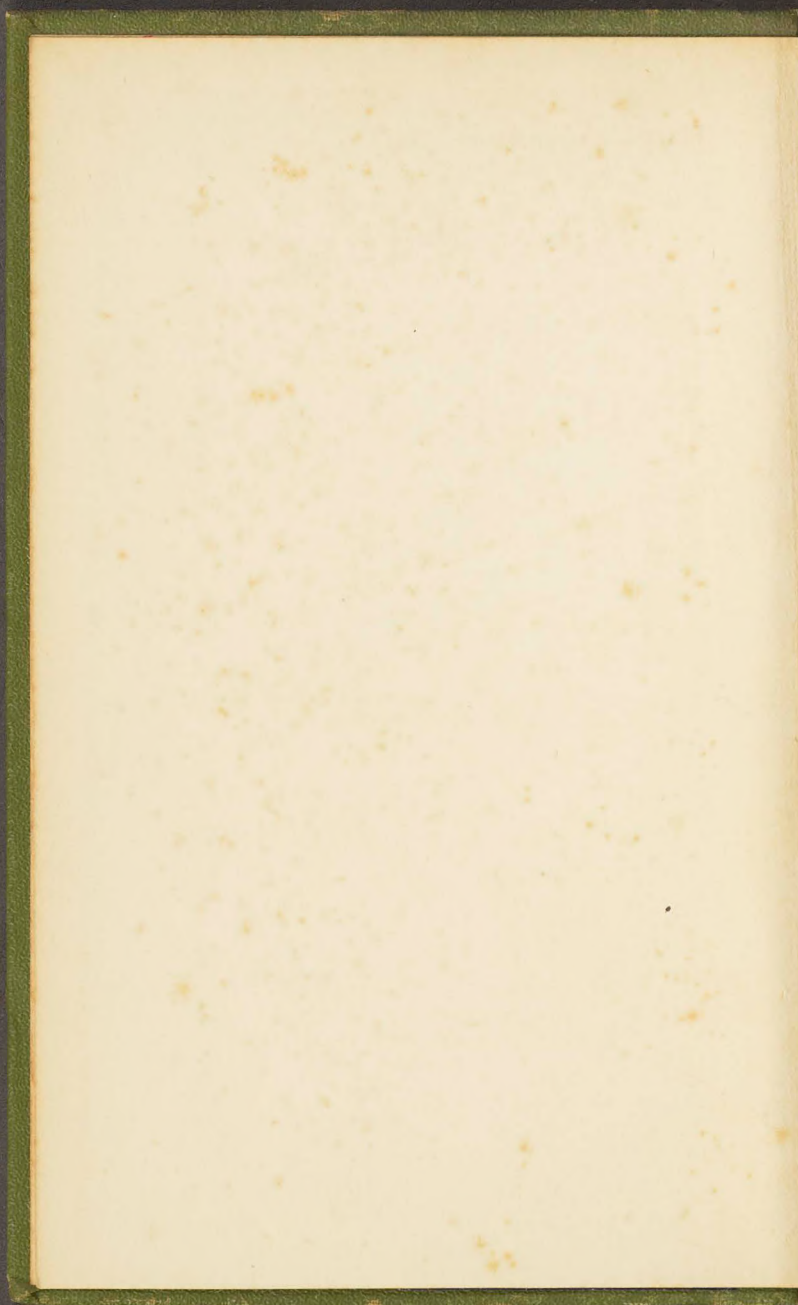
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Flavelle's Gem Series. No. 1.

The Story of the Noble Opal.

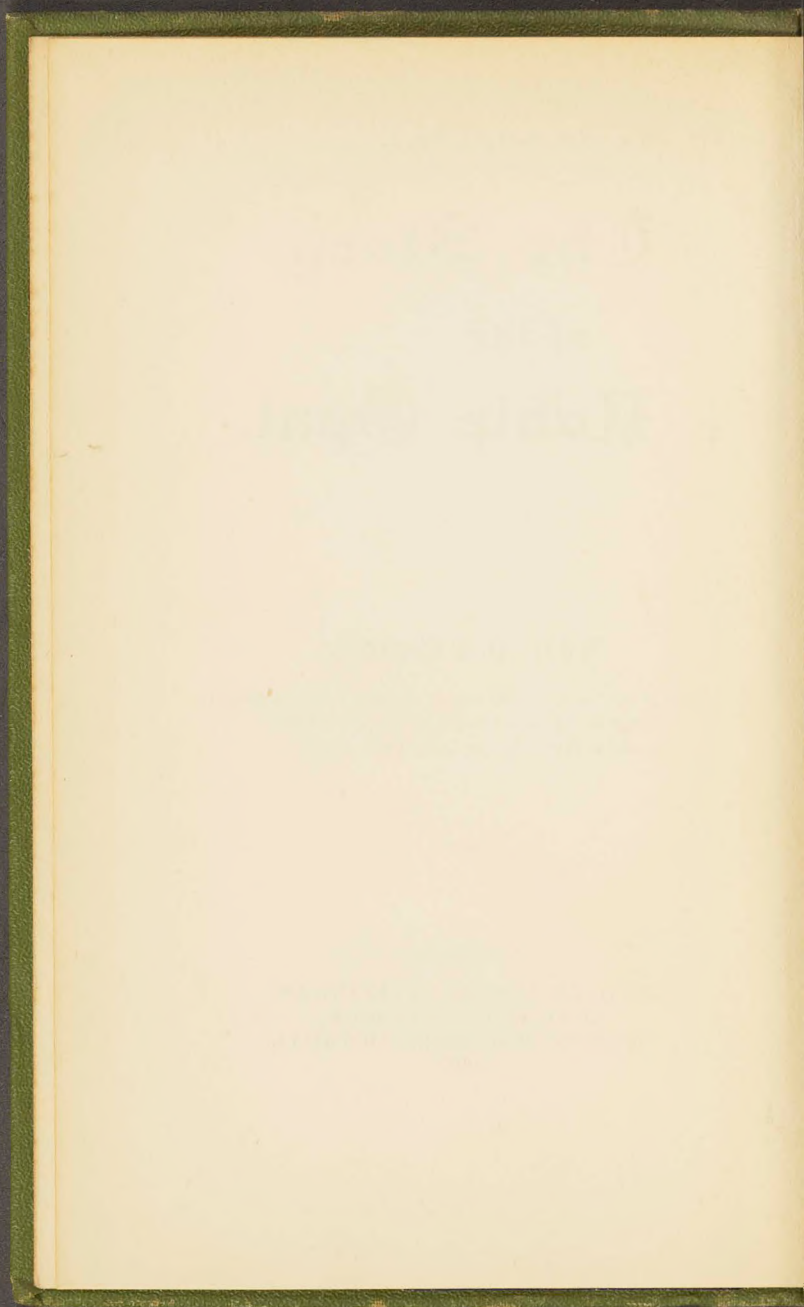
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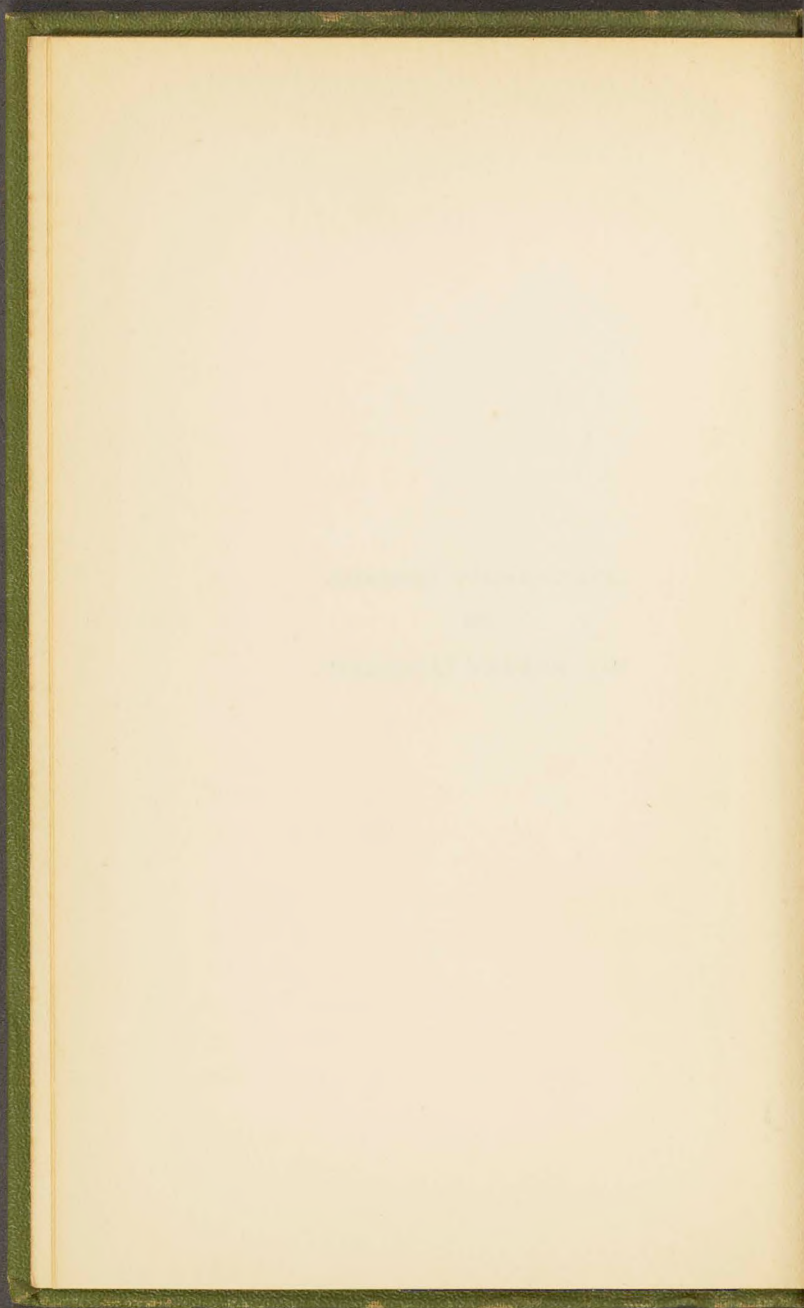
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AFFECTIONATELY DEDICATED
TO
MRS. ROBERT LONGSDON.



The Noble Opal.

CHAPTER I. THE NAME.

The story of the names of Gemstones is a rich mine as yet unworked by the scientific philologist. Not a single gem has a name that can be traced to any English, Teutonic or Celtic root, and comparatively few are of Greek or Latin origin; most have come to us from the East—some from Persia, a few from India, but the bulk are of unknown origin, and it may be that Egypt, Babylonia, and Assyria may yet prove to be the lands of their baptism, though, as yet, I have been able to trace but few to such sources.

The name *Opal* comes direct from the Latin *Opalus*, which was rendered in the Greek of the time of the Roman empire *Opallion*, but the stone does not seem to have been known to the ancient Greeks, and consequently there is no word to sig-

nify it in the old Greek writers. The word is isolated in the Latin language, and cannot be referred to any known root; it is probably a loan word, but whence derived there is no evidence to show.

In Pliny's time, about the commencement of our era, India, "or perhaps Arabia," was said to be the sole mother of the Opal, but this was probably only another way of confessing ignorance of its origin; for then, as now, it was the fashion to ascribe all sorts of rare and costly things to the mysterious and shining orient. I know of no Indian locality for Opal, and the official report on the *Economic Geology of India* (1881), which cites all the ancient as well as the modern records, makes no reference to it; nor does Dana give any Indian locality in the latest edition of his classic *Mineralogy*, though he pays special attention to places of origin.

The name cannot, therefore, be Indian, and I incline to the belief that *Opal* was the native name given by the miners of

Hungary. Of course they were not what we know as Hungarians, who are a Mongoloid race of comparatively recent introduction into Europe. For this opinion, however, I have no evidence as yet to offer; still, it is not a crude guess, for I have expended much time and research into the subject of mineralogical philology.

All we can definitely say is that the Romans in the Augustine age first became acquainted with the stone, and received with it the name *Opal*, which they did not invent.

They had another name, or nickname, *Pæderos*, that is Cupid, for this and other stones. It, as Pliny himself notices, is a mere distinction of loveliness that had become a name; and as Dan Cupid is the rosy-fingered god, stones with a rosy tint like the amethyst and garnet were called *Pæderos*, and there can be no doubt that the term was also applied to the Opal, especially such as had a red or rosy flash.

Another name cited by Pliny has a

bearing upon the supposed Indian origin. After describing undoubted Opal, he says, "the best kind is found in India, where it is called *Sangenon*." Now this is an undoubted Indian word. In the official *Economic Geology of India*, already cited, a list is given of modern Hindustani names for minerals, and no less than eighteen have the prefix *Sang-i*, that is, "stone of," and though none approaches *Sang-i-non*, there can be no doubt that in Pliny's time certain Indian stones had this prefix. Now, as carnelian is *Sang-i-akik*, and garnet *Sang-i-mehtab*, it seems reasonable to suppose that certain Indian stones well-known to the Romans as coming from India (among them the fine carnelians and carbuncle garnets) were known by their Indian names, and as the home of the Opal was (erroneously) supposed to be Indian, one of the oriental terms was occasionally applied thereto. It is to be noticed that no stone of a blue or green tinge is called *Sang-i*; they are invariably some shade of red, purple, brown, or black.

Pliny goes on to say, "the next (best kind) in Egypt, termed there *Tenites*." No one seems to have paid attention to this curious word. In a vocabulary of ancient Egyptian words I have drawn up for a forthcoming work on the *Mineral Substances of the Bible*, I find what seems to be the original of the Latinised term. It is variously spelt *Tehen*, *Tahan*, *Tahn*, and *Tahnen*, and is generally rendered *Crystal* by Egyptologists. Now, I cannot remember any Opal in the grand collection at Boulak in Egypt, nor have I seen any (so far as recollection goes) in any of the Egyptian collections in London, Paris, Germany, or Vienna, and I have failed to find any notice of this stone in any inscription, or description of Egypt, Babylonia, or Assyria. None has been found in Greece or the Islands. Yet had the stone been known, the Egyptians, who had a keen eye for gemstones and almost worshipped the turquoise and lapis lazuli, would assuredly have prized this uniquely exquisite mineral—it has never been gazed on by mor-

tal eye without exciting admiration. It certainly does not occur in Egypt.

But whence came Pliny's undoubtedly genuine Egyptian name? I think in the same way as his *Sangenon*. It was a term for some form of coloured quartz or chalcedony, and the Egyptians prized both, and especially the Rose and Sapphire Quartz. I look, then, upon these Indian and Egyptian names as mistaken transfers from other stones.

It has already been pointed out that the etymology of the name of this stone is unknown; it puzzled the early mineralogists, who, like others, delighted in real or fanciful derivations, and the Opal did not escape the onslaught of these pseudo-philologists. An old writer, Marbodius, boldly declared it to be *Ophthalmius*, the Eye-stone. His reasoning is clear, and convincing in the days (not entirely passed), when the Doctrine of Signatures held sway. According to this "philosophy," the medicinal herbs and stones had their virtues stamped in their shape or colour—brown stones were

good for liver complaint; red ones acted like a charm in hæmorrhage, and as the Opal delighted every eye, common sense showed it *must* be good for sore eyes! So Opal was *Ophthalmius*, and the word being too long and not coming trippingly off the English tongue, it got shortened into *Ophal*, and so we read in the list of Queen Elizabeth's jewels of "a Flower of gold garnished with sparkes of Diamonds, Rubies, and Ophals, with an Agate of Her Majesty's viznomy."

Of the many names, mostly modern and self-explanatory, applied by mineralogists and jewellers to the varieties of Opal and its allies, only two call for notice, and this rather from their poetic feeling than their scientific or historic worth. To the pellucid opal suffused with bluish and with a rosy flush when held against or turned in the sunshine, the name of *Girasol*—Turn-Sun—has been given, just as it has to the Sun-flower of our gardens, and in that it lacks the iris sparkles of the Noble stone, the Germans have prettily christened it *Waise*—the Orphan.

CHAPTER II. WHAT IS OPAL.

The chemical analysis of the rocks which form what geologists call the crust of the earth brings out the curious fact that about sixty per cent. of the material is *Silica*, either free or in combination with other substances.

To the free silica the name *Quartz* is applied. In its perfect crystalline purity it is *Rock Crystal*; in its granular form it is familiar to all as *Sand* when in loose particles; as *Sandstone* when compacted together. Quartz is the commonest of all minerals, and takes on every conceivable form and colour, from opaque veinstone to perfectly transparent crystal—the dull flint and the purple amethyst which lines its cavities are alike forms of quartz. We see it in the agate, the onyx, and the sard; it is the tender green chrysoprase and the dark green bloodstone; it is the costly jasper and the despised buck-reef of the gold prospector. It is with us everywhere upon the solid earth, from the drifting sands of the shore and desert to the mountain top.

All this is, to all intents and purposes, pure silica. True, it may be stained with trifling quantities of various oxides, to whose presence much of the colour beauty is due—but it is pure silica for all that to the chemist and mineralogist.

But silica can exist in another form; it can take *Water* into combination; it can become *hydrated* as chemists have it. Now this *Hydrated Silica*, this silica which has chemically combined with water, is Opal. It is easy to detect this hidden water, this *water of crystallisation*, as it is called. All that is necessary is to place a splinter of Opal in a piece of glass tubing and strongly heat it. The water is driven off as steam, and condenses on the cool part of the glass, and at the same time the stone becomes opaque and loses all its beauty. Exactly how the water of crystallisation exists in the mineral is a debated question beyond our present scope; but as the amount is variable (and for other reasons) it has been thought that, though always present, it is not essential.

One of the reasons for thinking the water may not be essential is that silica, like a good many other substances, occurs under two conditions having distinct properties. In the one—that most common in nature—it is practically insoluble either in alkalis or acids, but crystallises readily (e.g., Quartz), while the other form is readily soluble and never crystallises, from which property it is known as *amorphous* silica—that is, formless or uncrystallisable.

Opal is amorphous quartz.

The two forms can be changed one into the other, and in nature we have mineral substances with both kinds intermixed, as we shall presently see.

Opal, then, is amorphous silica, and not the crystalline form, and as it possesses this quality independent of water, and as the quantity of water in Opal is not a fixed proportion, it may very well be that the water is non-essential, though always present. This does not exhaust the argument, but is sufficient for our purpose.

CHAPTER III.

OPAL'S POOR RELATIONS.

It is impossible to understand the story of the Noble Opal without taking into account the allied forms which are neither noble nor precious.

We have already said that the greater part of the minerals which go to form the bulk of the earth's crust contain silica in combination with other substances such as sodium, potassium, calcium (lime), magnesium, and iron; now all these minerals are continually undergoing decomposition, especially within a few hundred feet of the surface, and in many cases the combined silica is set free. It may be freed either as the crystallisable or the amorphous form, and if the latter it is readily soluble, either in alkaline or acid waters, and may be re-deposited. In this case, it forms the *mineral* Opal.

The most abundant source of amorphous silica is spring water, especially that of hot springs in volcanic districts. These deposit their silica on the edges of

the pools, sometimes in enormous quantity, and in all sorts of fantastic forms, from solid rock to kidney-shaped masses, coral-like structures, and even filmy threads. The once magnificent Fairy Terraces of Rotomahana, N.Z., and the equally wonderful deposits in the Yellowstone Park, where they attain a thickness of hundreds of feet, and the similar deposits of the Icelandic geysers are all Opal—lustreless and worthless to the jeweller, but still Opal. It goes by the general name of *sinter*, and may sometimes be seen forming under bridges and culverts in which cement has been used, and forming small stalactites and films.

Opal of this common sort is often the fossilising material of trees, though true quartz is most frequent. Such fossil trees of *Wood Opal*, as it is often termed, may be found in the tin gravels under the basalt at Herberton, N.Q., near Hobart, Tas., and large tree trunks are frequent in the pumiceous rocks of some parts of Hungary. Here one may pause

to note that both in Queensland and New South Wales the fossil shells and cuttle bones (*belemnites*) of the Cretaceous rocks are sometimes converted into true noble Opal, a phenomenon unknown to me elsewhere.

The finer sorts of *Common Opal*, translucent to transparent, but white, yellow, or green, and occasionally red, but without any fire or iridescence, is plentiful in many parts of Queensland, as near Springsure, and should not be altogether despised, for some of it would cut into beautiful objects such as paper-weights.

The opaque, porcelain-like, bluish-white variety which goes by the Tartar name of *Cacholong*, also occurs in Queensland, but I have not seen it in mass. It turns up occasionally in quite unexpected places—the finest I ever got I found embedded in plumbago in the Graphite mines of Bohemia.

Nor is Opal always dissociated from quartz. The chalcedonies, which we best known as agates, carnelians, onyxes, sardonyxes, etc., were probably formed as

Opal, and have gradually changed into the chalcedonic form of quartz.

These are only some of the poorer relations of noble Opal, but a list of the chief varieties is appended at the end of this work, for those curious in the matter.

But this by no means exhausts the tale of Opal. Animals and plants fashion it from the soil and water. The marvelously beautiful aquatic plants known as *Diatoms*, which form such charming microscopic objects, make their tiny sculptured discs of Opal. These minute plants people every stagnant pool and water-hole. They exist in countless myriads in the ocean—indeed, upon the sea floor about the antarctic circle there falls a ceaseless rain of these little graven jewels, which the explorer's dredge brings up as pale straw-coloured powder. Nor need we seek the ocean depths to find the accumulated diatom—waste forming rock masses—in Virginia, in Bohemia, in Scotland, and elsewhere, there are thick beds of *diatomaceous*, or as it

is more commonly called, *infusorial earth*. The housewife and the lapidary know it as *Tripoli powder*, and it is the *kieselguhr* with which nitroglycerine is mixed to make dynamite.

Nor is it only in microscopic plants that Opal is found. In India and China, probably in Queensland too, though I have not yet found it, Opal is formed in the joints of bambu, and is used by the native physicians under the local name of *Tabasheer*. It is Opal, too, which gives the stiffness to straw, and indeed it is found in many places where the unscientific would never dream of seeking it.

In the animal kingdom it forms the delicately beautiful skeletons of the minute marine organisms called *Radiolaria*, and the harsh spicules of many of the *sponges*.

The above is but a meagre and incomplete sketch of the poor relations of Opal, but it will suffice to emphasise the fact of its wide distribution, and bring into relief the rarity of the variety which alone merits the appellation of noble or precious.

CHAPTER IV.

HOW OPAL GETS ITS BEAUTY.

The beauty of Opal arises from its translucency and colour. All pure silica is colourless, and, we may say, transparent, for even the milk-white quartz owes its opacity to minute fractures—you know that if you grind the purest glass to powder it looks white. Pure rock-crystal is as limpid as water; pure chemically formed ~~amorphous~~ ^{amorphous} silica comes down as a transparent jelly, and there is a variety of Opal, *Hyalite*, which takes its name from being colourless as water; the Germans, indeed, call it *Müller's Glass* after its discoverer.

What we may call the *ground colour* of Quartz and Opal is due to the presence of minute quantities of foreign matter—it seems hardly kind to call them *impurities* as the chemists do. In the case of the amethyst, the colouring matter is a form of manganese. In the red sard or carnelian iron is the colouring matter. The chrysoprase owes its delicate leek green to nickel, and so forth.

At Oberstein on the Nahr, a large and legitimate, though to a mineralogist a shocking industry, in colouring chalcedonies has been carried on for centuries. The art in Italy is at least as old as the beginning of the Christian era; indeed, Pliny says in his time there were as many artificial as natural agates on the market.

But notice, the Germans can only colour the chalcedonic bands in the agates; tinting the pure quartz is beyond their skill. We have already seen that chalcedony is, or was, an admixture of crystalline quartz and amorphous Opal, and this, owing probably to subsequent alteration, renders the chalcedony bands somewhat porous, and it is into the pores that the stains penetrate. The Romans claimed to be able to stain the very substance of true crystal, but it is more than doubtful, and certainly no examples have survived. The fact is, that a quartz crystal, and to a lesser extent Opal, has its particles or molecules too closely packed to admit of absorption

of foreign matter—the little stones of these minute temples fit together closer than the perfect masonry of the old fane that lies between the out-stretched paws of Egypt's Sphynx. The tint of the amethyst and the ground colour of the Noble Opal are not mere film-stains but pervade the stone itself, and were born with it.

There is, indeed, a form of Opal, intermediate between the coarse, opaque Sinter and the Noble Opal, which is somewhat porous—it will adhere to the tongue. It is translucent or whitish, and is called *Hydrophane*, the “Water-clear,” from its property of becoming more transparent when placed in water. This property arises from the outer parts having lost their water and become opaque; on steeping part of the water is replaced. Some of our Opals from the extreme North of Queensland come near to this form, but they are filled with changing pale pink, or yellow, or pale blue, but without any of the fiery flashes of the true stone. They might truly be

called *Girasols* from their changeful hues, as they are turned towards or away from the light.

This colour change is not entirely due to the inherent hue of the colouring matter, for this would only give a single tint. It arises from the exceedingly minute size of the colouring particles, which allow only certain rays to pass through them and reflect quite different ones.

This delicate, changeful blue merits a little closer attention. Milk is white—*milk-white* and *snow-white* are terms for spotless purity, for absence of all trace of colour. Yet the old joke about the colour of town milk so delicately touched upon by Oliver Wendell Holmes' Latin tutor in the lines—

"To me, alas! no verdurous visions come,
Save yon exiguous pool's conferva scum;
To me no concave vast repeats the tender hue
That laves my milk-jug with celestial blue."

is based on scientific observation. Mix half-a-dozen drops of milk in a tumbler of water and look down upon it against a dark background; it is distinctly and

beautifully blue, and moreover is just the tone of the blue of the Opal. Now hold the glass before the window and look through the mixture; it is no longer blue, but the lurid coppery tint of a storm-cloud at sunset—and again it is the colour of girasol Opals.

Professor Tyndal, long ago, delighted us with the artificial blue skies he made in tubes. A non-technical friend described it thus:—"Here the Professor filled a tube with vacuum, and holding it up, showed us nothing. It was black. He then moistened a bit of blotting paper with some chemical, chucked it into the tube and out again so quickly, that even the smell hadn't time to stop behind, and the nothing in the tube turned sky blue."

Now this *dichroism*, or double-colourness, is very easily imitated, as you may see in any bit of the appropriately named *Opal-glass*. Even in science this particular bluishness is called *Opal-escence*, from being characteristic of the Hungarian Opal.

So far, we have learned to distinguish between two distinct classes of ground colour due to extraneous matter, (a) what may be called *ordinary colour* due to simple reflected light, and (b) *Opalescence* due to reflected and transmitted light from very minute particles.

It is however, to a third class of colour that the Opal owes its unique beauty, and in this case it is due entirely to the *structure* of the stone, and is quite independent of any extraneous colouring matter. This is the exquisite play of colours, which is known as *iridescence*, a term aptly made from *iris*, the Latin for the rainbow.

It is not possible to enter into an explanation of the optics of iridescence; it must suffice to say that it arises from the breaking up of the rays of light—the colours, in fact, *are in the light and not in the stone*. Of course, strictly speaking, all colour is in the light, but no confusion can arise from our rather unscientific way of putting things if the main fact be realised that the iris tints are

absolutely independent of the nature of the substance exhibiting them.

Imagine light-rays to be shreds of rainbows deftly woven into strands so cunningly, that the colours do not show, and let these strands be so fragile, that they are frayed out into colour wisps, when, in their flight, they are dashed against sharp particles of hard matter, and you have a rough picture of how *Diffraction Colours* are formed. Light cannot pass through narrow slits or tiny holes, or scrape against the edge of a solid substance without being so frayed, as you can easily prove by looking at a small bright light through your eyelashes. If they are too short, look through the feather-web of a quill pen.

Nor is it essential that the light pass through the fine apertures. The same thing happens when light is reflected from fine lines on an opaque substance. Years ago a Mr. Barton made metal buttons that glowed and flashed with pure iris colour, by engraving fine concentric lines thereon. You can imitate this by

taking an impression of mother-of-pearl with black sealing-wax, and the wax will be found to be almost as brilliant as the shell.

Light is similarly broken up into its colour constituents by very thin films, as we see on the soap bubble, and the iridescent film formed by dropping kerosine or tar upon water.

Illustrations of these diffraction colours abound everywhere, but most require looking for; indeed, light cannot pass the edge or side of any object without getting frayed. The precise mode in which this takes place would need too long an explanation, but any elementary text-book on Light will give the data.

To diffraction from small particles, fine lines, or thin plates are due the solar and lunar haloes, but not the rainbow. Diffraction paints the peacock's plumes; it bejewels the crests and gorgets of the humming birds; puts the sheen upon the rifle-bird, and spangles the diamond beetle. It paints the pearl-shell and turns the dull felspar into the shining

Labradorite. Sir David Brewster, as long ago as 1845, searched for the cause of the Opal's fire with the best resources of his time, and concluded that it was due to diffraction from thin films of air in minute cavities within the stone.

But we have more strenuous modes of attacking such problems nowadays, and Brewster's explanation is not the whole truth.

There is, indeed, yet another way in which light rays are unfrayed, and, if possible, the most wonderful of all. A crystal is a temple not made with hands, whose stones are more perfectly wrought than the deftest craftsman of Hiram of Tyre dared dream of. The joints of these molecular building stones are so true, that even the deep-seeing microscope fails to perceive them. But when rays of light traverse such a crystal, they split in two, one part proceeding on its journey unchanged in character or direction, while the other diverges from its normal course, and is, as it were, flattened. Such an abnormal ray

we call *Polarised*, and it gives rise to beautiful colour effects. All crystals, save those of the Cubic System (diamond, garnet, etc.), polarise light. Amorphous, that is, uncrystalline substances, have no such power, and by special means it is quite easy to at once determine whether any substance is crystalline or amorphous in structure. Paste gems are now made so perfect, that they deceive all but the very elect—but one glance through a polariscope reveals instantly and indisputably that they are but glass—for glass, though limpid as crystal, is amorphous.

There is, however, one apparent exception to this otherwise universal rule. If glass be strained, as by bending a rod, its particles are so compressed and stretched, that they polarise light, and give rise to iris tints.

In the year 1861, Prof. Schultze showed that one form of Opal—the clear Hyalite or Muller's Glass—showed polarising effects, and that this was due to tension. Diamonds, by the way, often

exhibit this property in spite of their cubic crystallisation—and this tension or strain is sometimes so marked in South African stones, that valuable diamonds have been known to fairly explode when removed from the protective pressure of the matrix.

In 1871, Prof. Behrens made an exhaustive examination of Noble Opal, and proved that the characteristic fire is due to thin curved lamellæ (plates), having a slightly different refractive power from that of the mass. These, he considers, were originally formed in a parallel position (much like the flakiness of puff paste), and to have been afterwards bent into curves, cracked, and broken up during the consolidation of the mass.

These broken, curved lamellæ must produce polarisation, and their very thinness must originate colour, but the minute pitting and striation of Brewster still remain a colour factor.

The unique beauty of the Noble Opal is thus seen to be a very complex pheno-

menon. Nature has lavished upon this stone all the riches of light. Simple colouring matter gives the ground-tint; fine particles produce the opalescence; while the supreme beauty of the spangled fire is called forth by all the battery of light acting upon thin plates, fine lines, and the strained lamellæ which indicate the throes of the Opal's hour of birth. No wonder that every eye finds delight therein, for this stone above all others symbolises the majesty and transcendant fertility of Him who IS Light.

CHAPTER V.

THE GEOLOGICAL HOME OF THE OPAL.

From what has already been said about the almost world-wide distribution of silica, it follows that Opal must be of common occurrence in many places. But, from what we have learned concerning the characters which distinguish the *Precious* or *Noble* from the *Common* Opal, it is equally clear that only under conditions that but rarely occur, can the valuable gemstone be formed. All that is absolutely essential for the production of the *Mineral* Opal is some source of amorphous, or as it is also called colloidal, silica, and this condition is often found, not only in volcanic districts, but in others devoid of all traces of volcanic action.

To cite a few cases. On the top of the Chalk, at the base of the Tertiary rocks about London, there is a well-defined old sea-bed, and in this, for example at Woolwich, amorphous silica is not uncommon; again, further south in Surrey, in

the Cretaceous rocks, a certain bed is so full of it, as to be commercially valuable. It is known as Firestone. This region is, and for long geological ages has been, free from volcanic disturbance. Again, both in New South Wales and Queensland, the Opal-bearing beds are Cretaceous in age and marine in origin. On the other hand, the Opals of Hungary are derived from a volcanic rock known as trachyte.

It requires, then, something more than the presence of amorphous silica to produce the Noble Opal—it needs those conditions that produce the strain and lamination which give the fire to the gem. Let us consider what those conditions are.

They involve the production of incipient lamination and subsequent fracturing of the laminæ. By far the most powerful agency, or, at any rate, the most imposing and stupendous, in this direction, is the mighty force of mountain building. To this we owe our fissile slates and schists, and indeed all the

rock masses which have had lamination impressed upon them. But of surety, opalisation is none of these. If it were, so the Opal matrix must, of necessity, have shared in result, but it is not so—the matrix remains unchanged while the Opal has become modified, and further, as the Opal prospectors know to their cost, an Opal vein is never filled with the noble variety, which is always confined to a limited space, the bulk consisting of absolutely worthless common Opal. We must seek some other cause for opalisation.

We find such a cause, and a very probable one, in contraction due to solidification. Take our Australian Opals as examples. They are found in rocks of Cretaceous age (Desert Sandstone, etc.), which are of marine origin, and have been gently upheaved without any disturbance to speak of, and certainly without any crumpling such as we get in mountain regions. The Opal is newer than the rocks in which they lie, as is proved by the fossil bones, shells, and

wood, which have been opalised, and by Opal filling in cavities from which other minerals (pyrites, gypsum, etc.), have been removed. Here let me pause to remind the reader that these casts (or *pseudomorphs* as mineralogists call them) give a spurious appearance of crystallisation to the specimens. Opal cannot crystallise, but it takes in these cases, the form of the cavity from which the crystal has been removed, just as a blanc mange takes the shape of the mould.

Nor is it the fossils alone that tell this story. In the Opal beds of New South Wales there are rounded boulders of slaty rocks, for it is an old shingle beach—and these certainly were not Opal-bearing, yet their cracks are filled with precious Opal.

CHAPTER VI.

THE BIRTH OF THE NOBLE OPAL.

All Opal, we have learned, is amorphous or colloidal silica, and this substance is far more widely spread than the layman imagines. Not only in igneous rocks and sandstones, but in most, perhaps all, limestones of any geological antiquity we find veins and nodules of flint and chert which were once in this condition, but it is in the volcanic and sandstone rocks that the Noble Opal is born.

It might be concluded from this that Noble Opal is the child both of plutonic and neptunic parents—that it was unique among gems as being born of fire and water—but it is not so. Amorphous silica is always of secondary origin, always produced from solution, but the solution need not be of high temperature. The presence of Opal in volcanic and other rocks that have solidified from a state of fusion is due to solution and redeposition long after the parent rocks

have solidified, and all that is required is sufficient heat to allow of the slow evaporation of the solution of silica of lime.

Nevertheless, there is a distinction of great industrial value between the Noble Opal from the volcanic, and that from the sedimentary rocks. In the igneous rocks the Opal is simply deposited in veins and cracks, and is always what may be called an accidental mineral; it is never an essential ingredient, but is derived from some mineral already existing in the rock. Consequently it is always rare. Thus, in the famous Czernewitza mines in Hungary which, till the discovery of the Australian gems, supplied most of the market, the Opals are found in very small nut-like masses, and it is said that only once in several years is one discovered as large as a shilling. On the other hand, Opal which has been formed in sedimentary rocks, like most of that of N.S. Wales, and all of that of Queensland, is much more widely distributed, because it has been formed from

the dissolved silica in sea-water, and deposited on a sea-floor; though the actual solidification may have, and indeed actually has, taken place long after the ocean bed had become dry ground. Judging from what I have seen of the curious amorphous silica deposits of the Tertiaries near London, and the Cretaceous near Farnham, in England, and from a comparison with the Queensland beds, I am more than inclined to think that such soluble silica has settled upon old shore lines, sometimes shingly, at others pretty free from ought but sand, and upon which life was pretty abundant, especially sponge life.

There is a curious tendency possessed by many chemical substances (perhaps all, under certain conditions) which are sparsely disseminated through a rock, to gather together in beds and veins, and especially in concretionary nodules. We call this action *segregation*, but cannot explain it. The lime carbonate segregates out from a clay, for example, and forms great nodules (called *septaria*

from their in-filled shrinkage-cracks), which were once the source of the raw material of Roman cement. Similarly, too, are formed the so-called irony *pans* and *pugs* in gravels so well-known to alluvial miners, and many other cases might be cited. Such segregations gather round some solid nucleus, especially if of like nature. Thus silica will accumulate around siliceous sponges, and chert about siliceous radiolaria. These conditions are admirably presented on a shore line. But before elaborating this idea, we must revert to the physico-chemical properties of silica itself.

Many substances, both elementary and compound, though identical in chemical nature, exist under two or more forms often possessing widely different physical properties. The most striking, perhaps is *phosphorus*, which, in its ordinary condition, is a transparent, almost colourless, waxy substance, highly inflammable, and deadly poisonous. The other form is remarkably different. It

is not waxy—is opaque, dull red, only inflames at a high temperature, and is not poisonous (however, it is not wholesome). It is familiar as the chocolate-coloured material on the friction-paper of safety-match boxes. The two forms can be changed one into the other, and the red kind is the less stable.

In like manner, as already stated, silica exists in two forms, the more stable and common is crystallisable, and practically insoluble. The less common form is uncrystallisable and readily soluble; it is easily converted into crystallisable silica, and even at ordinary temperatures in time passes into that condition. Opal is soluble silica.

When a dilute solution of silica is slowly evaporated, the silica separates out as a thin, transparent, gelatinous substance, which, on drying, shrinks, owing to loss of water, and shivers into innumerable cracks, but does not fall to pieces.

It is easy to picture a sandy shore bathed with sea-water holding much

silica in solution. Let such a shore be gradually elevated. The sand will act as a filter, allowing the water to pass away, but retaining much of the silica, which will gradually gravitate to the bottom. Here are all the conditions for the deposition of the Queensland and Wilcannia (N.S.W.) Opal—and, if this theory be correct, we ought to find a sandstone, more or less charged with amorphous silica, having at its base a shingly deposit containing fossil shells, bones, wood, etc., partly the flotsam of the sea, partly the jetsam of the land, all more or less rich in Opal. Also, we should expect considerable quantities of ironstone to be segregated out.

All these conditions are found in our Opal Fields. Both in Queensland and N.S. Wales the Opals occur in sandstones of Cretaceous age, the formation being known as *Desert Sandstone* from its prevalence in the so-called desert region of Central Australia. It is a marine deposit, as proved by the fossil shells, etc.; it is a shore deposit, as shown

by its basement shingles, and the quantities of (silicified) wood it contains; indeed, sand is never deposited in deep water far from land. Over much of the area—many thousands of square miles—some of these sandstones are so finely grained, that they have been mistaken for grey or white clay or shale, and over all the Opal country much of it has been hardened into thin platy beds, as if the material were half baked. To such rock the appropriate name of *Porcelainite* has been given, originally from the baked clay that is found in contact with volcanic and other igneous rocks. This porcelainite has a significant interest in the origin of our Opals, as we shall see directly.

Fine grained sands, such as described, will, on drying and consolidating, shrink and crack like drying mud, and the shrinkage—cracks, both horizontal and vertical, will form admirable receptacles for the reception of gravitating gelatinous silica, which will also worm itself into all the crevices between the tiny

sand grains. So much for theory; now let us examine the facts.

The cracks in all rocks may be found filled with silica, forming ordinary *quartz veins*, and cavities lined or filled with quartz or chalcedony (*agate*) are plentiful as perjury in a horse case. But the silica *lines* the sides of the cavities—it has been deposited on the walls in successive layers, as agates show beautifully.

But in a vertical crack filled with Opal quite a different arrangement is seen. It fills in the cavity as if it had been poured in from the top and not as if it had merely trickled down the sides, and the banding is *across* the vein, and not parallel to the sides, showing that it was not introduced as a fluid bathing the walls and depositing its contents upon them, but as matter poured in and then consolidated. Moreover, if any Noble Opal occurs therein, the best is at the top of the vein, and its Harlequin spangles run *across* it. Further, as you trace the vein downwards, the Opal be-

comes more and more impure, mixed with particles of rock and grains of sand, just as we should expect, and bits of wood are caught up in it, as flies are in amber.

Again, in the basement-shingle some of the boulders are cracked, and have the fissures cemented with Opal; others, such as certain slate boulders, which were originally veined with pyrites or calcite, have had these minerals removed and replaced by Opal. Occasionally, too Opal is found in *clusters of apparent crystals*, and we have seen that Opal cannot crystallise. In this case, groups of aggregated crystals of gypsum have been replaced by Opal, atom by atom—a process we call *pseudomorphism*. It is as if, say, a house had each brick removed one at a time and a marble block inserted in its place, till Brick Cottage was converted into Marble Hall. In this way, also, shells, cuttle bones (*belemnites*), bones of great reptiles (*Plesiosaurus*), and wood, have been pseudomorphosed into precious Opal—medals

of Creation of the costliest and rarest type. Not alone in the veins and fossils do we find this evidence of the deposition of Opal from gelatinous silica saturating the sandstone. Among the more shingly beds we find precious Opal in nodules, and layers, and films, associated with, and often enclosed, in ironstone. And it is not very rare to find particles of ironstone, sand, and other minerals caught up in clear Opal, showing that at the time of deposition the Opal was in a gelatinous condition. *Sand-shot Opal* is one of the banes of the lapidary, often appearing only on cutting, after the stone has been bought as pure.

Let us now return to the Porcelainite. How did it get porcelainised? What has it to do with Opal? and what connection have either with *kangaroos*? These three apparently unconnected and anomalous questions we have to solve.

Porcelainite, as ordinarily understood, is baked shale or clay, common on the edges of igneous dykes, due to partial fusion. But no living soul ever saw

porcelainisation extending over thousands of square miles, and covering the ground, as it were, with shattered tiles of pretty poor manufacture. Yet this is what we find in Queensland. True, we have extensive sheets of basalt, vieing in area with the porcelainite, but the basalts do not porcelainise the beds on which they lie (as a rule); even when they repose immediately upon lignite they do not affect it as much as a smoothing iron does the ironing board. Clearly, the basalt has not been the porcelainiser, though in places it may overly such beds. As a matter of fact, in Queensland, the Opal fields stretch for some five hundred miles north and south without coming within two hundred miles of the basalt. The basalt must be left out of consideration, and there are no other igneous rocks in the Opal area.

With respect to the second question, this particular porcelainite is not baked clay at all—it is not true porcelainite, not natural pottery, but rather what we might, to coin a name, call *Vitrite* or

glass-stone, except that it is almost pure silica, whereas glass is a mixture of silicates. I find, on analysis, that our Opal-field porcelainite is an almost pure mixture of soluble and insoluble silica, and in this I see the explanation, and it is here the kangaroos come in.

Respectable Darwinian evolutionists have been pleased to point to our Continent as an example and a warning against isolation. See, they say, how Europe, Asia, Africa, and America have, by free geological intercourse since, say, Triassic times, developed all sorts and conditions of Mammals from the lowly Marsupial to the lofty giraffe, while conservative Australia has never got beyond the Monotreme stage of the Platypus and the maternal-valise stage of the Wallaby! This is pretty, and should keep us humble.

Unfortunately it is not true. It turns out, or, at any rate, is turning out, that our marsupials are *not* a survival from Triassic forms; that we are *not* poor benighted folk still dight in garb elsewhere

discarded ages ago as unfashionable, but that they are genuine home-made Australian animals, fashioned out of old-world placental forms, and adapted to our own Australian wants. Sir Richard Owen got a glimpse of part of the truth years ago, as early as the forties of the last century. He threw out the suggestion that the marsupial character of the Australian mammals was an adaptation to climatic conditions; but the pouch and its modifications, including the immature character of the newly-born enabled the brooding mothers to carry their young with them in long-distance journeys in search of water in times of drought. It sounded poetic then; it became a source of ridicule to a newer generation, and will yet be cited as an inspiration by a wiser one. The theory should appeal to all Australian bushmen, for they are all marsupials themselves, only they carry their pouch in their hands or at the saddle—D! Climate, and long distance between waterholes, have given origin alike to the pouch of

the wallaby and the water-bag of his hunter.

Now for the application of this seemingly incongruous set of propositions. If the pouch-and-water-bag theory be true, it follows that our climate has not changed appreciably since the introduction of the higher animals—say, since Mid-tertiary times. Incidentally it will be made clear that this is not the climate of pre-marsupial times. Finally, it will be shown that the new—the present—climate gave rise both to the Opal and the 'possum.

A glance at the geological map of Australia shows that the Continent is split right across by a broad belt of marine beds, which separate it into an eastern and western island. The larger of these two islands comprises West Australia, except the north, and most of South Australia. As it is the home of the characteristic Australian flora and fauna, we will call it *Australian Australia*. The smaller mass was a long, narrow land, extending from Cape York to

Tasmania, with flanking islets to the west. As it was connected with, and received from, Asia, many plants and animals we will call it *Asiatic Australia*.

The Cretaceous Sea which separated Australian from Asiatic Australia, was shallow, as is proved by the beds which were deposited all over its area, and so far must have been like the Arafura Sea of to-day.

But the climatic conditions were very different. The Cretaceous Sea allowed of the interchange of the warm waters of the north and the cool waters of the south, right across what is now Central Australia, giving rise to a comparatively cool condition, in which reef-building corals could not grow. It may be urged that the water was too charged with sediment to allow of coral growth. But it was not more muddy than the seas which preceded and succeeded it, in which corals abounded. Yet, so far as I know, there is an entire absence of corals, reef-building or otherwise, in the Cretaceous rocks of Australia. Both Australian

and Asiatic Australia had their climates so ameliorated, that they must have enjoyed insular, as distinct from continental climates. The very extent of the Cretaceous rocks, too, points to these old Australias having been exceedingly well-watered, for it is the water-borne waste of the land which formed the rocks in the bed of the Cretaceous Sea. While that sea existed there were none of the higher vertebrates in either of the Australias.

It is only with the last phase of the Cretaceous Sea that we have to deal. It was gradually shoaling, owing to steady elevation being in progress, and this accounts for the great preponderance of sandy beds, which have given the name of Desert Sandstone to the top-most member of the series. And the Desert Sandstone is the home of the Opal.

Elevation continued until the whole of the Cretaceous Sea became dry land. The broad strait between Australian and Asiatic Australia was bridged over and finally obliterated, and the land became,

for the first time, one great continent, never to be broken up again. It was the earliest Federation of the States of the Commonwealth. Coastal regions in the west and south were to suffer depression and re-elevation, but neither Queensland nor Central Australia were ever again to sink beneath the waves. Federation was complete and final; there was to be no more Separation.

Mark now, not what may, but what *must* have happened; yet in mercy draw not political moral therefrom! With Federation came inevitable deterioration. The Coast Range and flanking lands of Asiatic Australia originally had bountiful rains on the west, as now on the eastern slopes, and Australian Australia was almost equally favoured. But with the drying of the Cretaceous Sea came the desiccation of Central Australia—it was a gigantic cutting off of the water supply.

This happened in Tertiary times; but elevation did not stop when the Cretaceous Sea bed was raised to its present

level. It went on until Asiatic Australia was united to Asia proper, at least as far as Timor on the west and New Guinea on the east, and across this temporary bridge came the early mammals and many another animal and plant, and by it the Eucalypts may have passed into Timor, where they give a characteristic Australian aspect to the landscape. To one familiar, like the writer, with these Asiatic lands, it is startling to enter Australia from the north, and to see again in the magnificent scrub the familiar primeval forests which he had left in those Gardens of the Sun which cluster about the line. In like manner an Australian landing in Timor, say at Deli, and climbing the hills towards the Estana encounters the gum-trees of his own land as colonies of naturalised aliens.

I have said that the early mammals came from Asia *via* Asiatic Australia, but I cannot stop to prove this—we only have to deal with marsupials in so far as they tell the same story as the Opals.

It was till recently universally believed that our marsupials were the descendants of the early marsupials, whose remains are found fossil in Triassic, Cretaceous, and Tertiary beds, in Europe and America, and that while in the older continents these creatures developed into higher forms, in Australia, owing to its isolation, they retained their marsupial character through all the wonderful modifications they have undergone. It is now becoming more and more clear that instead of being old-world Tories that have refused to march with the times, they are brand-new Australian natives, made to suit the climate, just as the boundary rider, the prospector, and the shearer are brand-new types developed out of old Englishmen. The old-world immigrants would have died of thirst had they remained tied to their mothers' apron strings. They were originally placental mammals; they have taken the back trail along the ancestral route—that is, if, with most naturalists, we agree that the early Triassic mam-

mals were marsupial, and not insectivores—but they may, with true Australian cunning, have reinvented non-placentalism for themselves.

There has been time enough for the development of all our marsupials since they first arrived on Australian ground. There has elapsed the whole period of the Tertiaries—an epoch in which most of the great mountain ranges of the earth have been uplifted—the Alps, the Himalayas, and the Andes. They were almost certainly evolved on Australian ground, for no trace of them is found in the rocks of Europe, Asia, or North America, and only in comparatively recent deposits in Patagonia have their allies been discovered, and this very doubtfully—and that land of fabled giants has other things in common with the land of the Wattle, and may have received her marsupials (except true originally placental mammals; they have opossums) from us. [It is now proved that these Patagonian mammals have no relation to the Australian marsupials. Subsequent note.]

We know not yet when the immigration started, for there are no rocks of Tertiary age known in North Queensland, and the beds of that age I am examining around Brisbane have proved as yet barren in this respect. Whatever the precise geological date at which they arrived, it is certain that they had not penetrated as far west as Australian Australia till late Tertiary times, for the older Tertiaries of Victoria, South Australia. and N.S. Wales show no trace of their presence, but by Pliocene (Upper Tertiary) times our marsupials had not only evolved all the existing types, but the giants also, which became extinct in that era. In Pliocene times, also, marsupials had spread practically all over Australia and Tasmania, though curiously the Platypus has even yet only reached the fringe of northern Australian Australasia.

The great fact I wish to emphasise is that during the long Tertiary period, as Australia became drier and hotter with the cutting off of the rain supply, there

was not only *time enough* for the development of our marsupial types, but a *cause* for it; the original immigrants had to change or die. They have changed—but not more than the mammals of the Old and New Worlds. It is to Asiatic Australia that I look for the locality of the great change, at least in its earlier phases; it is still richest in species, and has doubtless peopled the rest of our continent. Kangaroos, in fact, are due to the change of climate consequent upon the conversion into dry land of the strait between the two primeval Australias.

Now let us see what this great climatic change did for the Opal. Picture the last phase of the Cretaceous upheaval, when the sands, which will afterwards form the Desert Sandstone, were gradually being raised above water, and let these sands be charged with silica in solution. The salt and other easily soluble material will soon be washed out by the rains: the iron will tend towards the bottom beds, and the soluble silica will begin to settle in the cracks and

joint-planes. The rainfall steadily diminishes in quantity and the climate becomes hotter and drier.

There now arises a very remarkable set of conditions, which I believe had a great influence on the Opal, as it certainly has upon the commercial value of the land.

The *Desert Sandstone* is the uppermost bed, or rather, series of beds, of the Cretaceous System, and still retains its original horizontality to a very great extent. The Lower Cretaceous rocks upon which it lies fall into two series—first, the *Rolling Downs Formation*, consisting chiefly of practically water-tight shales, beneath which lies a thick bed of extraordinarily pervious, very friable, sandstone, to which Dr. R. L. Jack gave the name of *Blythesdale Braystone*. It is believed by those who understand the Scottish tongue to be a very appropriate name, but a poor Sassenach like myself can only realise its pretty alliterativeness, and accept the rest with the humility of racial inferiority.

These Lower Cretaceous rocks were

tilted to the west before the Desert Sandstone was deposited. In geological parlance, the Desert Sandstone lies horizontally and unconformably upon the upturned edges of the Lower Cretaceous beds. This apparently insignificant arrangement has had a very marked influence upon the climatic condition of the Opal fields and Central Queensland generally.

As soon as the Desert Sandstone became dry land, it began to be fretted away by the denuding agencies of rain and river, and the edges naturally suffered first. Hence, along the eastern boundary of the old Cretaceous Sea much of the Blythesdale Sandstone now lies exposed, which was formerly covered by Desert Sandstone. Indeed, that sandstone is now so worn down as only to appear as isolated patches—wreckage whose wide distribution attests its original expanse.

The result is that the rains which fall on the eastern lands, and which would naturally flow as streams over the west-

ern lands, is trapped by the Blythesdale Braystone, which lies like a huge sponge along the western flanks of the eastern hill country. The central lowlands are thus robbed of much of even the scant water they would, under any other geological conditions, receive. Many causes have thus led to the dessication, and to the enhanced temperature of the Opal-bearing country.

The water trapped by the Blythesdale Braystone is not entirely lost to Central Queensland. Owing to the steady westerly dip of the Braystone, the water flows downwards beneath the Rolling Downs beds, and is the artesian supply tapped by our deep bores. Opals, kangaroos, and our artesian water supply are thus proved to be intimately connected, and all to be the result of the obliteration of the Cretaceous Sea, whose waters, being withdrawn, converted the Australian Archipelago into the Australian Continent. They and the climate are the first-fruits of the first Federation.

These results are so remarkable, so unexpected, and so unparalleled elsewhere, that it will be well to condense the evidence into a few pithy sentences.

1. Before the Cretaceous Period, the Australian region was an archipelago, of which the two principal islands were Australian Australia and Asiatic Australia.

2. These islands were separated by the shallow Cretaceous Sea.

3. This sea allowed free water circulation from the cool Southern ocean to the Arafura Sea, across the centre of the present Continent.

4. The Australian Archipelago enjoyed a mild, insular climate, with bountiful rains.

5. The Cretaceous Sea was not warm enough to support reef-building corals.

6. At the close of the Cretaceous era the Cretaceous Sea was finally upheaved, and the present continental conditions established.

7. At this time there were no terrestrial mammals in Australia.

8. Upheaval continued (through Tertiary times) until Australia was joined to Asia on the north-east. Terrestrial mammals, and other Asiatic animals and plants crossed into Australia, and Australian forms passed north into Asia, as witness the Eucalypts of Timor.

9. The original mammals which crossed to Australia were placental and not marsupial.

10. The shoal waters in which the Desert Sandstone was laid down were highly charged with silica in solution.

11. The upheaved Desert Sandstone is still rich in this colloidal or soluble silica.

12. On the obliteration of the Cretaceous Sea the climate steadily deteriorated, becoming hotter and drier, owing to:—

(a) the cutting off of the cool water from the South.

(b) the diminished rainfall, due to

the obliteration of the Cretaceous Sea.

- (c) the exposure of the porous Blythesdale Braystone by denudation, and the consequent trapping of the surface water from the east.

13. The water so trapped flows westward underground, and is our artesian water. Much of it would have naturally irrigated Central Australia.

14. Owing to the above causes, Central Australia has been converted into a huge sand-bath.

15. This facilitated the solidification of the silica in its colloidal form, and prevented its conversion into insoluble quartz.

16. As the Desert Sandstone dried and contraction-joints formed, soluble silica filled in the cracks by gravitation.

17. The silica was in the condition of a thin jelly, permitting any included solid particles to sink through it.

18. Hence in vertical cracks the Opal is invariably purest at the top.

19. Hence, also, the Opal is most abundant at the base of the Sandstone.

20. The bulk of the colloidal silica still remains in the body of the fine-grained beds of the Desert Sandstone.

21. Much of this fine-grained rock has become quasi-porcelainised by the slow evaporation of the water under the influence of the sun's rays.

22. The Porcelainite is chiefly silica and not silicates, and has been produced by solar and not subterranean heat.

23. The formation of true Opal, including the Noble Opal, was at first rapid. It is still proceeding, but very slowly, owing to the diminished water supply.

24. As the country became more parched and hot, the terrestrial mammals became modified to suit the new conditions.

25. Our Marsupials are, therefore, not *Survivals* but *Revivals*—unless, as is

probable, they are entirely new developments.

It is my intention shortly to publish the whole of the evidence of this remarkable, and hitherto unsuspected, series of consequences of the effects of the elevation of the Cretaceous Sea upon the climate, the minerals, the mammals, and the surface and underground water supply of Australia.

CHAPTER VII.

OPAL AS A GEM.

The preceding pages may have led the reader to wonder why the gem Opal is so expensive, seeing that the mineral Opal is so common, the Opal Fields of Queensland alone covering a thousand square miles. But while Opal—of a sort—can be obtained by the ton, the precious or Noble Opal is always bought by the ounce, and few and far between are the finds of single pieces of an ounce in weight. Then again, much of the Noble Opal occurs in thin scales or coatings, almost useless to the lapidary; and even when the thickness is such that stones can be cut from it, the pattern may be poor or the colour bad, and often an apparently fine stone, purchased at a high price, turns out to be sandshot and valueless when cut. Good stones are still rare, and the supply is not equal to the demand. You may still agree with Burns and—

“Ask why God made the gem so small
 And why so huge the granite
 'Twas that He meant mankind should place
 The greater value on it.”

The possessor of a fine Opal need be under no apprehension that the gem will decrease in value—personally, I am sorry for it, for things of beauty cannot be too plentiful, and it is the acme of ostentatious vulgarity to estimate beauty by coin of the realm. Poppies among corn, blue-bells in the copse, and forget-me-nots by the margin of the brook, would not be more charming if only trust magnates could acquire them, and the rainbow, the Opal of the heavens, is given us without price.

The story of the Birth of the Opal, too, has been told in vain, if it be not realised that Opal mining is no holiday task; no fine, free, open-air life in a delightful paradise where it is ever spring, and where winding, flower-fringed brooks are shingled with jewels. It is serious, strenuous labour, in a parched semi-desert, where water has often to be carried for miles—where the miner, as we

have shown, has to become a marsupial, like the "big, black, bounding beggars" that flee before his face. Be sure, then, if you be mercenary your Opal investment is gilt-edged. One might even ask you—parodying Cowper on the sugar-cane—compassionately to

"Think how many backs have smarted
For the gem your purse affords,"

but that the Opal miner needs no compassion for a life, which, though hard, is self-imposed, and buoyed ever with the hope of great reward.

What constitutes a fine Opal, from the jeweller's point of view?

Till quite recently the type of the Noble Opal was determined by the most brilliant stones from the Hungarian mines. These have a milky ground, with brilliant flashes, which from the nature of the ground are subdued in brightness, as if seen through thin gauze. The finest Australian stones have the same milky ground, but less deep in tint, so that the flashes show out clearly, and are as brilliant as the rainbow itself.

From a purely artistic aspect they are unquestionably the most beautiful Opals known. But fashion, directed by trade jealousy and vested interest, decreed these gems to be of second-rate value. Indeed, there was an attempt to boycott them on the London market. But their inherent beauty conquered, aided largely by the discrimination of our fair American cousins, who, having no fear of Hatton Garden, or indeed, anything else, before their eyes, persistently declined to be put into trade leading-strings. And to-day, wherever Opals are held in esteem, and that is wherever civilised or barbaric man delights in splendid jewels, our Queensland Noble Opal takes precedence of all others.

A fine Opal, then, must have an appropriate *ground colour* to set off the *fire*, and this should be milky, with perhaps a tinge of blue. The *flash* or *fire* must be pure in colour, and should be definitely outlined. The pattern should be regular, and the rarest and justly most esteemed, is that in which the pattern is

like a mosaic of tesserae cut from the solar spectrum. Such Opals are termed *Harlequin*, and deserve a more aristocratic baptism. Harlequin Opals, it need hardly be said, are of great rarity, and it is almost hopeless to try and match them from separate stones—a perfect suite can only be obtained by cutting a large stone into smaller ones. Fine Opals like fine pearls, increase rapidly in value by being matched.

Though no man can admire the Harlequin Opal more than I, yet I confess that some of our other varieties delight me quite as much. We have one sort which has a spangled pattern, and also indefinite, long, flashes, like little levin bolts of crimson and green. Their beauty breaks like summer lightning as the stone is turned about, and this very transientness of the flashes is an additional grace, as is the play of colour on the throat of a humming bird. It gives “atmosphere” to the stone, to use a painter’s phrase, and like a fine impressionist picture, suggests more than it defi-

nately expresses. It is as the gift of reticence in poetry—it trusts to the appreciative imagination—one might tire of rainbows if they were persistent. The charm of music is that it dies so soon—we would not always have Handel's Largo falling on the ear—this Opal is music—it is the Largo in Silica. It hath no name—let me christen it the *Leven Opal*.

There is a curious property about these flashing Opals, that I am surprised the old folk who dowered gems with mystic virtues never seized upon. It is the most human of stones—the only one that responds to the touch of kindly hands. Warm your Opal in the palm of your hand; its colours will take on a brighter glow as if in sympathy. Lay them by in cold neglect, and the fire will die down as if half banked. But let not this pretty conceit carry thee away, for there be Opal copers as well as horse copers, and they will try and foist on thee pallid stones warm from the stimulating lamp; buy stones with cool hands as well as with a

cool head. But this is a little excursus by the way, and we must return to the Opal, and to the Queensland Opal in particular.

Speaking broadly, Queensland Opals fall into two classes—those with an *ironstone* and those with a *sandstone matrix*. Both have the same origin, both occur in the same area, and it is difficult to say which yields the finer gems. It may be taken as a general, but by no means invariable rule, that the ironstone yields the deeper tinted, the sandstone the lighter hued stones. The ironstone, however, is the sole matrix of the splendid, but comparatively unknown, *Black Opal*, to be presently described.

The ironstone in which the Opal occurs is, as already pointed out, of secondary origin, and has segregated out from the sandstone. It is usually in concretionary nodules, formed in concentric coats or layers: and like all such concretions, is full of contraction—cracks and planes of weakness between the layers, besides being more less porous throughout. Into

these cracks, etc., the Opal has penetrated, so that we find it in all sorts of conditions, from thin films, like a glaze, any tiny threads like glorified gossamer, up to half-inch plates and concentric masses—banded and eyed agates of Opal and ironstone.

Much of it is opaque, dull yellow, dirty, or otherwise worthless, but some of it is the most gorgeous Opal known. Among it we find, especially as films and scales, the deepest and richest of pure violet, with spangles of shining ultramarine, pale turquoise blue, with glittering fleckings of sea green; and yet again perfect Harlequin and other matter, with spangles of blue, green, gold, orange, and fiery red. Indeed, almost every variety of Opal is found among the ironstones.

From some occult cause much of this Opal, especially that which is in scales, is banned by that irrational monster, Fashion. Yet it is of incomparable beauty—it is dreamily lovely—it reminds one of the rapt visions of the poet

Keats, of the unmatched sunsets of Turner's brush—it is Swinburn and Giorgione in imperishable stone. True, it will not cut into ring-stones or necklace pendants; gems are meant to adorn other things than fingers and throats, though they make exquisite brooches. For all kinds of inlaid work, and for such pretty trifles as paper-weights, ash-trays, and a thousand and one nick-nacks, they should be ceded at least equal rank with malachite.

The very depth of colour of the matrix, warm, ruddy brown of all shades, from the lightest sienna to deepest Rembrandt umber, is the most artistic background imaginable.

What I have said about these unjustly despised ironstone thin Opals applies equally to similar sandstone Opals. In both it not rarely happens that fairly thick, pipy Opal has caught up fragments of the matrix along the back of the pipe. Fashion says, I will have none of it. Yet that same addle-headed Hydra will pay fancy prices for a piece of Rock-

crystal with similar inclusions, and will call them by all sorts of pet names. There lies before me a piece of ironstone pipe-opal, two and a half inches long, three quarters of an inch wide, and half an inch thick. It is almost clear wine yellow, with a slight milky tinge, through which swim scores of clearly-defined large spangles of shining blue, green, orange, and red; and the Opal melts, as it were, into the ironstone at the back, and has picked up little bits of fawn-coloured ironstone, which lie at all sorts of tottery angles. To me it is a miracle of condensed beauty, and it would make a shawl-brooch Anthony might have wooed Cleopatra with. Mrs. Grundy would not look at it; Cleopatra would have cherished it—so, methinks, would Queen Alexandra.

From the ironstone we get that matchless and little known gem, the *Black Opal*. As the Black Swan was to the ancients among bird wonders, so was the Black Opal—something to be dreamed of, something possible but hardly

probable—and Australia has given us both. It was unknown to the ancients, or Pliny, who goes into raptures over the Opal, like the wise man and artist he was, would have mentioned it. The lost Opal which the great Napoleon gave to Josephine, which was called the “Burning of Troy,” from its fiery flashes has been thought to have been a Black Opal, but from the description, I feel pretty sure it was one of those red-flashing Opals on an ironstone background, which Mdm. La Mode of to-day, not being a Napoleon of any sort, affects to despise. Even as lately as 1892 Mr. Streeter wrote, “Under the Name of Black Opal, a stone appeared a few years ago in the market, and, like anything new, was eagerly sought after, and attained a high commercial value. Certainly the colours are very lovely in these specimens, yet how they acquire their blackness and deep tints is questionable. Some other hand than unassisted Nature may have been at work.”

If an expert thus erred, what chance

had this admittedly beautiful gem with the amateur? The very honesty of the gem-merchant was against the stone, and to this year of 1907 the Black Opal, rare and matchless as of yore, is valued at much less than its recognised brother. Yet it was Messrs. Flavelle, the publishers of this work, who were among the first to put the Black Opal before the public. They know it, I know it; every miner and most visitors to our Opal-fields know it; and we all know it to come direct from Nature's own laboratory.

But there are Black Opals and Black Opals. Let me illustrate. Many years ago, when I was one of the officers of the English Geological Survey, it fell to my lot, with others, to map what is now the valuable Northamptonshire Ironstone. We traced it for many miles, and found it to pass insensibly and horizontally into pure white siliceous sand. This is a fairly parallel case; we have the replacement of silica by iron oxide in both cases, the only difference being

that in England, the silica was the crystallisable variety (quartz), and in Queensland it was the uncrystallisable form (Opal). In both places you can find every possible gradation from pure silica to pure ironstone. In Queensland you can gather flint-hard ironstone peppered (*irrorated* as an entomologist would say) with Opal points, like the stars in the Milky Way—it was known to the old French lapidaries as *Prime d'Opal*, that is, Pebble Opal. From this you can pass on to ironstone into which the Opal has run as molten glass would run into and bind ashes together. In the next step the Opal predominates over the ironstone, and this is the commoner sort of Black Opal. Remove all the ironstone and leave only the Opal stained with iron as Smoky Quartz is with carbon, and you get the rare and matchless gem, the true Black Opal.

It is, however, among the Sandstone Opals that we find the greatest variety. Apart from the fine *Harlequin* and other kinds of Noble Opal, already described,

we have every variety, from the dull white and yellowish *Cachalong*, which clings to the tongue by its porosity, through the transparent *Hyalite*, which has no spangles, and looks like rich but delicately tinted stained glass, to the *Girasol* or *Fire Opal*, which, when perfect, seems to hold an imprisoned Glow-worm.

It is unnecessary to repeat what has been said about the veins and nodules of Opal in the Desert Sandstone, but there is one mode of deposition that demands special notice. It is known as *Pipe Opal*, and occurs in long ovoid masses, in colour and shape not unlike the Finger Cakes which, when I was a boy, always tasted like crêpe, for they were handed round at funerals, as melancholy tokens of woe. They average about five inches long, by an inch wide, and half an inch thick. (My wife, who is a Londoner, warns me to keep confectionery and mineralogy apart. She calls them Savoy Cakes, which smacks rather of Gilbert than graves—

but so long as you recognise the thing, its associations matter not.) These pipes are often completely filled with pure Noble Opal.

The Opal pipes are, as Mr. C. Fraser, of Messrs. Flavelle's tells me, never found in a vertical position, but lie at more or less high angles with the planes of bedding. I am quite unable to account for their particular shape or position; but, then, sand-galls and ironstone concretions are always puzzling in the fanciful shapes and positions they assume. Usually the upper and lower surfaces of the pipe have a more or less continuous layer of Opal in which fragments of sandstone are caught up. Often the Opal fades, as it were, imperceptibly into the matrix. In some pipes the pure Noble Opal occupies the upper half of the pipe from top to bottom, with impure and opaque Opal in the lower part; but there is no fixed arrangement. The pattern lies, as a rule, across the pipe, and is parallel with the longer axis.

As would be expected from the mode of origin, most of the Opal comes from the base of the Desert Sandstone, and much is found in detrital material derived therefrom.

The Opal, not being a transparent stone deriving beauty from internal reflection, is not cut in facets, but with a curved surface—*en cabochon*, to use the technical term. It is not well suited for engraving for two reasons. First, its particolour destroys, or rather hides, the workmanship; and secondly, it is not only very brittle, and so dangerous to engrave, but the internal minute fractures which give the flash-colours, often cause the stone to splinter under the graver's tool. Nevertheless, our Queensland ironstone Opals make exquisite cameos, the dark matrix forming a fine contrasting background. Personally, I think them a mistake; the delicate lines in a face and in the hair, are lost in the maze of changing colour. Still, I have seen boldly cut heads that only an empirical criticism would denounce, and

Messrs. Flavelle have cut tiny Opal doves for pendants that are perfect. The Opal renders charmingly the "livelier iris," which, in the springtime, "changes on the burnished dove."

Much of the Opal that at present finds no market will, as taste becomes divorced from Mammon, be wrought into things of beauty, not necessarily for personal decoration, but for the dainty trifles that beautify the home. Everyone delights in the purity of cut glass—surely the glass-clear Opal is as chaste. Opal Matrix is more delicately beautiful than mother o'pearl or the Haliotis of New Zealand—perhaps even the nouveau riche would patronise it, if it were vended under its French name Prime d'Opal—roses by other names by no means smell as sweet—to some folk.

And now a few words as to the care of Opals. Few stones require more attention; none repay it better. Remember that the Noble Opal is as dainty in body as in dress; its tender tints are a reflex of its delicate nature. Many an old

Opal has become dull and lustreless, and has lost its fire—and all by ill-usage and neglect.

Opal is a soft stone as gems go; it is not as hard as crystal, which jewellers class among soft stones, and it can be scratched with a knife. Hence Opal rings should not be worn during working hours. If you have the opportunity of seeing Opals polished, as you may do at Messrs. Flavelle's, you will be astonished at the softness of the material which puts on the final gloss, and receive an object lesson from which your Opals will benefit.

Again, Opal is porous, and consequently absorbent. This is best illustrated by an opaque variety, *Hydrophane*, which, when placed in water, becomes translucent; even our *Cachalong* adheres to the tongue owing to its porosity. Though Noble Opal is not so open in texture as these, it is still porous, and remember the fire is due to minute fractures. Hence Opal soon becomes dull from its pores becoming clogged

with dirt—another reason for taking off your rings while performing the duties of chatelaine. The pores are so fine, that it is exceedingly difficult to clean Opals—indeed, it is an impossibility for an amateur. Readers of “Kim” will recollect that one of his teachers was a skilled Opal rejuvenator. Nothing less than fell disappointment is the lot of the novice who tampers with his Opals. Opals, indeed, alike from their delicacy of constitution and delicacy of beauty, are not work-a-day stones; they pertain to the graces, not to the battle of life.

Some Opals, too, are impatient of continuous exposure to strong light. Now, on all these counts Opals lay just claim to tender treatment. They should be, not less, but more prized in consequence—Opals belong to the satin gown, not to the print blouse.

CHAPTER VIII.

THE MYSTERY AND POETRY OF THE NOBLE OPAL.

From the earliest times Gem-stones have been endowed with mystic virtues—Babylonians, Assyrians, Egyptians, Indians, and Jews, all valued gems as much for their supposed mystic properties as for their beauty. Indeed, the Jews, until about the Roman era, esteemed them for no other reason. From Genesis to Malachi there is no word to show the Chosen Race adorned themselves with gems for mere personal decoration.

The rarity of the stones, which made them precious, proved, in the illogical philosophy of the times, that they must be special arks for the enshrinement of Nature's choicest secrets and subtlest powers. Their unparalleled hardness was emblematic of their capacity for holding fast the secrets entrusted to their keeping—all wise Nature would not, dare not, could not, risk her most

precious treasures to the guardianship of anything perishable. And the Divine presence proclaimed itself in flashing beams of colour. It was all so simple, so self-evident, so philosophical—and so stupid.

It was so stupid it could never die. It was the prototype of relic worship—it is seen to-day in the resurrection of the ancient lucky-pigs that ladies, half-shamefacedly dangle from their bangles. It achieved the dignity of a quasi-science, in the Middle Ages, as the “Doctrine of Signatures.” Nature, taught this pseudo-philosophy, “signed,” or stamped, everything useful or baneful by shape, colour, odour, or other property. Old “Herbals” are based upon it—the pretty little English plant we still call *Eyebright*, from its flowers, like the eyes of Irish girls, was evidently the balm for smarting lids. Our *All-heal*, *All-good*, *Stitch-wort*, and *Liver-wort* still speak to us of their medicinal virtues, as do the *Dogbane* and *Fool’s Parsley* of the opposite. And the “doctrine” held full

sway over gem-stones. The wearer of the Sapphire's heavenly blue will remain pure as an angel, and burning Sappho's flame of love was kept alight by the blazing Ruby that lay upon her breast.

The Opal received kindlier treatment at the hands of the old Romans than was accorded to it by mediæval Europe or by modern Christendom, for, so far as I have discovered, there is not one hint that this stone, so elf-like in its changeful beauty, was of old anything but a joy for ever. It was reserved for Christian Europe, for a good bishop in solemn fact, to bespatter its fair fame with slander, and for Scotia's best novelist to crystallise the aspersions into permanence.

Pliny, the Roman naturalist, gives us the earliest description of the Opal, and goes into raptures about it, though he does not mention it as new; indeed, it must have been pretty well-known by his time. Pliny was an artist, as well as a scientist, and values gem-stones for their beauty and rarity rather than their cost; indeed, the Opal is the only stone of

which he quotes the price, and this only to point an anecdote, as we shall presently see. Listen to part of his description:—

“It is,” says he, “made up of the glories of the most precious gems; to describe it is a matter of inexpressible difficulty. There is in it the gentler fire of the Ruby, the brilliant purple of the Amethyst, and the sea-green of the Emerald, all shining together in an incredible union. Some aim at rivalling in lustre the brightest azure of the painter’s palette, others the flame of burning sulphur, or of a fire quickened by oil.” The translation is substantially that of the late Rev. C. W. King, whose unrivalled knowledge of ancient gems was only equalled by his skill, technical accuracy, and elegance in rendering into English the classic writers on gems and other mineralogical matters.

Pliny relates an almost incredible story of an Opal, which yet has a ring of truth in it. It appears that one, Nonius, a patrician, possessed the then fin-

est and largest known Opal. Pliny, who seems to have known the stone, has no doubt upon this point. It was the size of a hazel nut. Nonius cherished it as the very cockle of his heart, and it is only due to his memory to record that it was not the fabulous sum at which it was valued, about £160,000 of our money, but the gem itself, that charmed him. Now, Marc Antony coveted this gem, but Nonius was as adamant, and Antony was in office. So this pure patriot, who you remember, would not stir us up to any flood of mutiny, and who insisted on the recognition of Brutus and his friend as being strictly honourable men, proscribed Nonius, in order that he might legally annex the gem. But Nonius, the infatuated, fled to Egypt, preferring exile plus his Opal to the luxuries of life in the Imperial city, and the friendships of a lifetime without it. True, it was voluntary, and not judicial exile, and though Pliny says the Opal was the sole remnant of his fortune, we may hope

that one astute enough to evade the long arm of Roman law was able to conceal portable property bigger than a hazelnut. One wishes Pliny had gossiped a little more garrulously over the personal equation in this anecdote. How came Pliny to see the stone if Nonius got clear away? One shudders at the thought that after all, Pliny gazed upon an "unredeemed" pledge.

No one has seen this stone since Pliny's time, but early this century a French interpreter named Roboly pretended to have discovered it in the ruins of Alexandria.

The bard, who, under the pseudonym of Orpheus, wrote a long poem in Greek, upon the virtues of precious stones, was probably a Roman, though Mr. King, his only accurate translator, is half inclined to make him a Greek. He, like, Pliny, has nought but good to sing about the Opal. It is he who tells us it displayed "the complexion of the lovely boy"—that is, *Paederos*, whom we better know as the dangerous little archer Cupid, who

stole his mother's team of sparrows, and has been in mischief ever since. The singer takes us to the heights of Olympus, where the Opal is the delight of the immortals, and falls again to earth and humdrum life to note how the Opal, being fair to view, charms the strong eye, and strengthens the weak.

Thus the old Romans had associated the Opal with nothing that was not pleasing—it was the delight of man, mortal, and immortal, yet in its own dainty way it deigned to act as an eye-lotion. Now let us see how the Noble Opal fared at the hands of mediæval Christian Europe.

About the year 640, Marbodius, Bishop of Rennes, in what is now Normandy, wrote a *Lapidarium*, or Treatise on Stones. He culled from Pliny and Orpheus, and embellished his work with mistakes of his own. Ignoring the simple explanation that the curative virtue of the Opal was the natural result of its soft tints, he boldly twists *Opalus* into *Ophthalmius* as described in

our chapter on Names. Then he begins to libel the stone, and says it confers invisibility upon the wearer—not, mark you, for any good purpose, but as he expressly states, so that the Sykes' family may go a-burgling in the sunshine, and escape the risks of exposure to baneful night-dews! Fie upon thee, good Bishop! Doth not the purple Amethyst gleam upon thy episcopal finger raised in benediction? Did'st not read in those old Latin manuscripts how the Greeks, blundering philologists, like thy sacerdotal self, fondly and vainly imagined *Amethystos* was from *a-methuo*, wineless, and hence enabled the wearer to drink his comrades under the table, and still remain sober as a patent filter? Would not thy venerable sobersides have quivered with indignation had any lewd toper hinted thy ring was an "indulgence," a permit to look long and often upon the wine when it was red? Yet thou slanderest the Precious Opal, O! thou kindly but superstitious and addle-pated inculcator of wisdom and

righteousness! But thy sin be forgiven thee, on the score of invincible ignorance.

Four centuries later, when Marbodius' land had become Normandy by right of conquest, the Noble Opal suffered fresh indignities, and a crude story about Robert, clepe Le Diable, father of Conquering William, laid misfortune at an Opal's door. 'Twas but a single stone that foiled the luck of the House of Normandy, and with its loss the ban was lifted, and no other Opal suffered wrong. The spell was broken; but the Wizard of the North waved his wand, and lo! in "Anne of Gierstein," the Noble Opal was cursed, even unto this last. But yesterday a lady, educated and refined, a member of a scientific society, asked me—and asked me as a professional geologist, forsooth, if Opals were not, in very truth, really and demonstrably unlucky. I could have wept over her (for she was young and pretty).

Happily our Royal Family have been free from this superstition, though Rob-

ert of the Naughty Name is reckoned among their forbears. Our late gracious Queen Victoria, I am told, was especially fond of Opals, and frequently selected them as presents for relatives and friends. If one calls the roll of the thrones of Europe, and checks the members of her family who grace them, it would seem that the spell of the Opal could not throw its shadow upon such high places. The exiled Indian Prince, Dhuleep Singh, when he visited the land of his fathers, chose Opals as the gift for his mother, proving his superiority to the common belief, as well as demonstrating, that, as we have already shown, Opal is not to be reckoned among the Stones of India. The credulous have but poor Josephine for company.

Though the superstition is not dead, and never will depart so long as there are minds that take fearsome delight in the occult, yet it is on the wane, thanks largely to the breezy intellectual vigour of the charming Daughters of the West. It was doomed to obscurity when Queens-

land poured her treasures at the feet of Europe. Society was astounded, staggered, delighted. Then, like the Californian hero, it asked: "Can these things be?" And promptly began to doubt. For two thousand years it had been seeking for Opals which, with sufficient ground-tint to throw up the scintillations, was yet charged to the highest potential with spangles of blue, green, and gold, and above all, with matchless flash of crimson flame—and here she at last beheld them, brighter, purer than she had ever dared to hope, and this, too, not in solitary stones appearing, like comets, at odd incalculable intervals, but in profusion.

So fashion the unreasoning, doubted the evidence of her own senses; and the dealer, who is her lord, and not her bond-servant, as she fondly imagines, saw how he could tickle her vanity, and drive fresh rivets into the armour of his vested interest. He whispered that, after all, they were not the real thing, not the true Hungarian Opal, but only Colonial

stones at most. "Ah! Madam, but you have the true, tenderly sweet, intense aesthetic faculty. If I might say so, you are, perhaps, just a shade, a trifle, too, too sensitive to artistic colour—but I agree with you; these Queensland stones are too bright and perfect—they catch the eye at once; they are as the roast beef of the farmer to the white meat of the ortolan on your ladyship's Sèvres platter." And he turned aside and hummed something parlous like unto "a greenery, yallery, Grosvenor Gallery," something or other.

But the sickly sentimentality that preferred the green of the gall-bladder to the chlorophyll of a spring leaf languished its unmuscular decrepitude into an unhonoured and forgotten grave. The Queensland Opal was too honestly beautiful to be cold-shouldered at its *début*, and is now everywhere admitted to be the ideal Opal, and to stand in the front rank among beautiful stones.

A gem which has conquered slander and superstition may be trusted to hold

its own anywhere. Yet, according to my own observation, it is only beginning to make its mark among the Orientals. The European Turks esteem it equally with the diamond, but they received it early from Europe. In India, it does not yet rank with the diamond, the sapphire, and the ruby, or even with the turquoise. Prince Dhuleep Singh took it to India as much as a curiosity as for its beauty. We are entitled to hope that our own Ranji, now that he has taken to another royal game, may teach his brother-princes the cult of the Opal. Among the Chinese, too, the Opal is almost unknown; and this is curious, for they have a pretty taste in precious stones, and beautiful things in general. The sea gives pearl and coral; the mine yields precious metal and stone, for the button-badges of the mandarin's head-dress; and if you are inclined to fancy yourself a connoisseur of Jade, exercise your judgment in Jade Street, Canton, and then submit your selection to a Chinese friendly expert; you will achieve humility. But I

never knew a Chinaman—in China—to have a passion for Opals, and cannot recall ever seeing them in a Chinese jeweller's away from the treaty ports. The Opal seems, as yet, quite unknown in the Far East.

We have already seen that the Romans did not, with possibly rare exceptions, engrave the Opal. I am not sure we ought to ascribe this reticence to their aesthetic feeling. Fashion, blind and brainless on the Tibur as on the Thames, would have dyed the peacock's feather, and touched up the rainbow, had its gossiping leader so decreed. Crispinus, the exquisite whom Juvenal satirises as waving his delicate finger "to cool his light summer ring, being unable to bear the weight of his massy winter one," we feel sure would have meddled with the Opal if he could. But even a Roman dandy would hesitate to order a stone more costly than a diamond to be engraved if the chances were ten to one it would splinter in the process. It was the purse that protected the Opal from the Roman dude.

Here we pause to remind the reader there are two distinct species of engraved stones—the raised and the depressed—the *cameo* and the *intaglio*. The one we look *onto*, the other *into*; both represent solid figures rather than outline form; hence both depend upon light and shade; they are sculpture, not drawing. A little consideration will show that the material used must be such that it will reflect most of the light that falls upon it, and not allow it to be lost by passing into or through the stone, or the shadows which alone bring out the form will be lost. You could not tell the bust of John Burns from Robert Burns if both were cut in clear glass, and you could not distinguish Sir You-know-who from a patriot if both walked the street as transparencies. What we need is a certain amount of opacity in addition to solidity—glitter and transparency are fatal to the glyptic art.

But mark, if transparency be fatal, it is also merciful—it hides its victim—opacity is equally murderous and more

brutal, for it leaves the corpse on the highway. The finest sculpture, whether colossal or miniature, can only be wrought in a medium that allows some light to penetrate a little way and come back again—it must have a mede of surface translucency—it is the difference between living marble and dead limestone, between a sleeping and a dead face. For the perfect expression of portraiture in stone, therefore, we require a material of that happy optical medium between opacity and transparency which we find in the chalcedony. Opal, it is true, has this translucency (generally in excess), but for glyptic art its value is destroyed by the multitudinous changefulness of its peculiar beauty.

Mr. King only cites a single engraved Opal of Roman date, and this not from his own observation. It is a head of Sol, between those of Jupiter and Luna; it is an astrological amulet. The learned author mentions an Opal ring of the XIII. century, with cabalistic signs, again showing it was mystic and not

artistic merit which determined the engraving. But he gives an instance of pure portraiture in an Opal bust of Louis XIII., which he justly calls "a piece of unreasoning extravagance, where work and material mutually destroy each other's beauty and value, the iridescence entirely neutralising all effect of light and shade in the relief."

I cannot but think the Opal continued to be very rare up till the last few hundred years, for though I would not willingly put curb, or even snaffle, between the lips of sixteenth or twentieth century visionaries, I cannot think Peter of Arles in the time of great Henry of Navarre, would have babbled about a well-known stone as he did anent the Opal. Listen to a choice fragment—it is concerning a stone the size of a hazel-nut, like that of Nonius: "Grace went out from it; majesty shot forth from its almost divine splendour. It sent forth such bright and piercing beams, that it struck terror into all beholders." He is so certain of this property, he returns to it again and

again. It appalled "all hearts however bold and courageous. In a word, it filled with trembling the bodies of bystanders, and forced them by a predestinated impulse to love, honour, and worship it. I have seen it, I have felt it; I call God to witness."

It seems a pity Peter did not lend it to Henry at Irvy, then Macaulay would have written:

"Above the thickest carnage blazed
The Opal of Navarre."

The enemy would all have died of fright!

After this it is not astonishing, but natural, to find the grave Dutchman, Anselmus De Boot, who wrote in 1609: "*De Gemmis et Lapidibus*," telling us that "the wearing of it preserves the sight and the brightness of the eyes." Smile not, gentle reader; remember the learned lady and the unlucky Opal—you can buy a cramp ring in enlightened Queensland with greater facility than in benighted Italy—I know it, for I have tried.

If there should be left in you a trace, not amounting to anything so gross as superstition, but just sufficient of mysticism to add piquancy to your charms, take comfort in that the Opal's merits outweigh its woefulness. Giovanni Porta, in 1561, sums up as follows: "It stimulates the heart, preserves from contagious and infectious airs; drives away despondency; prevents fainting, heart disease, and malignant affections." And if October be your natal month, sing this, which I owe, with other details, to Mr. Tassin, of the U.S. National Museum:—

"October's child is born for woe,
And life vicissitudes must know;
But lay an opal on her breast,
And hope will lull the woes to rest."

Here is a curious bit of negative evidence, which seems to me weighty in support of the rarity of the Opal until recent times. Because negative evidence is a palpable contradiction in terms, and because it has been so misused by theorists of scant knowledge but unbounded confidence, it has been scouted by many

reasoners as if it were unlucky as Opal itself. Yet, in its place, negative is as good as—indeed merges into—positive evidence. What is the positive evidence that there are no trout in the Brisbane River? Nobody has scrutinised every fish that has ploughed its waters since the primeval trout was hatched. Surely, the negative evidence of every black and white Isaak Walton on its banks and bosom, that they never hooked, or speared, or netted, or poisoned, or dynamited, or cut a trout out of a shag's gizzard, is pretty conclusive.

Now, mediæval Europe took over the entire pagan stock of cabalistic nonsense and enlarged upon it. Twelve stones presided over the zodiac; twelve stones were potent over the twelve archangels; and twelve stones held sway over the twelve chief devils. The parts of the body were made up into a round dozen, each with its ruling stone, and every month had its spiritual gem. The apostolic virtues were enshrined in stones, the orbs of heaven, birthdays—every con-

ceivable thing concrete and abstract, had its own stone, and more than this, maleficent events could be exchanged for beneficent by propitiatory offerings of appropriate stones. No one who has not studied the question can realise how potent and all-pervading was the influence of stones. So hard pushed were these poor imbeciles for sufficient stones to mess about with, that they had to use the same one for different purposes, and to put up with opaque stones like jasper and bloodstone, and such common ones as agate and carnelian.

Now I have wasted much time raking over these old dust bins, and never once came across the Opal in any of their solemn lists. Surely the Opal, with its mysterious, changeful fires, must have appealed to these minutely painstaking seekers after symbolic association; it was exactly what they required. The inference seems plain, that it was too rare for them to make use of. And the same holds good for India, where it is still heresy to doubt the efficacy of gems.

Queensland is too young to have grown any romanticism of her own about gems, but Mr. C. Fraser, of Messrs. Flavelle's, who has travelled widely in our Opal-fields, tells me many of the miners are exercised about the origin of the Opal, and as I have ventured on a theory of my own, common fairness impels me to give a rival a chance.

A worthy miner confidentially button-holed Mr. Fraser, and asked him if he knew how Opal was formed. This was not seeking for information, but sparring for an opening—it was the humble student, not the proud Professor, he sought. Fraser confessed to an ignorance that was painfully childish.

“Look round,” said the theorist, with a wave of the hand, as if he were a cicerone illustrating Wren's epitaph. “Can't you see?”

“I see treeless hill-tops, with sandy soil and a few small trees below.”

“Well, them trees is Gidgees, Ring Gidgees. Now, don't you see?” Light failed to break, and Mr. Fraser said so.

"Well, then, did you ever see Opal where there is no Gidgees?" As no trees grow atop of the Desert Sandstone, the fact was admitted.

"Very well. Look at this," picking up a piece of silicified wood. "Now, isn't it clear?"

A bewildered shake of the head was the only response.

"Then I'll tell you. No Gidgee, no Opal. Where Gidgees lives they dies. Dead Gidgees turns to stone. Stone Gidgees turns to Opal, and there you are," and he rounded up the demonstration by producing a bit of fossil wood half opalised.

For the behoof of those who have not the priceless blessing of a knowledge of the Australian bush, let me say Gidgee is the native name for a species of *Accacia* peculiar to Central Australia. Botanists call it *Acacia homalophylla*, which signifies smooth-leaved, a very appropriate name since the Gidgee hasn't any leaves at all but only phyllodia. The wood is close-grained, hard, and

heavy, and is much used for boomerangs and spears. So I suppose Pipe-opals are broken spear-shafts. This theory I strongly recommend to theosophists, Christian scientists, *et hoc genus omne*.

Of celebrated Opals there is little to say. We have already mentioned those of Nonius the Infatuated; Peter Arles the Overwhelmed; and Josephine of the Sorrows; and in my reading I can find nothing of much general interest about particular stones, for the size and beauty of the Australian Opals have put all others into the shade. Some few years ago the Americans were enraptured at the discovery of a splendid stone at the Shirley mine, Owyhee County, Idaho, the size of a hen's egg, which cut into a fine stone of 325 carats. It is described as transparent, with magnificent green and red fire. This is undoubtedly a very splendid stone, but was not, however, as the Americans believed, the largest known, and its transparency shows it was not of the best quality. Now, before this, Willcania, N.S.W., had produced at least

two larger stones of perfect colour and pattern. One weighed, uncut, five and a quarter ounces, the other over ten. This is not mentioned in depreciation of the Idaho gem, but to show how Australia stands, and how comparatively little is known about her by the public at large. I do not know that Queensland topped the record for size. Messrs. Flavelle tell me the largest perfect stone they have cut weighed 64 carats.

If I were asked to select a characteristic stone for Queensland I should unhesitatingly fix upon the Opal. The only possible rival would be the Yellow Sapphire. But sapphire is so associated with Burma and Ceylon, that one does not think of Queensland when that gem is mentioned naturally and without effort. Moreover, our sapphire-fields, though very rich, are limited in extent, whereas not only can we show the finest Opals on earth, but they are spread over an area that would make a principality of enviable magnitude.

Then, too, I think the splendour of the

Opal, the witchery of its ever-shifting tints, is best paralleled on our coast. There is nothing so like the shimmering loveliness of the Opal as the play of early morning sunbeams upon a gently ruffled sea when thin haze lies upon the deep. And this you may see to perfection upon the pure waters inside our Barrier Reef. The film of vapour which clings to the surface while yet the morning sun is low, gives just the tempering cloudiness of our finest Opal, and the low-angled rays refracted by the lips of the wavelets flash out the prism-tints that are the Opal's glory. But the sea must be almost oily smooth—the wavelets long-sloping polished planes with steep but shallow edges, to opalise the face of the waters.

TO THE READER.

Messrs. Flavelle, Roberts & Sankey asked me to write a series of little books on gemstones, and gave me an entirely free hand. As this, the first of them shows, they will not be mere gatherings from other harvests, but original works embodying the results of my own experience. It was the study of the Opal, for instance, that led me to see that Australia is not an "arrested" continent, but the newest and most original. The germ of this idea will be found in this work; the details will shortly appear in the transactions of our Royal Society.

S. B. J. S.

Brisbane, 24th Feb., 1908.

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ERRATUM—p. 92, for *Amuthytos* read *Amuthystos*.

